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Mobile District Regulatory Overview/Update Seminar

Headwater Stream Assessment and Identification

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TOPICS

- Headwater Streams:
  - Definitions
  - Classification:
    - Order
    - Type
- Stream Indicators:
  - Geomorphic
  - Hydrologic
  - Biologic

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Headwater Streams

First or second order streams of a watershed without regard to location in the watershed or their classification as intermittent or perennial

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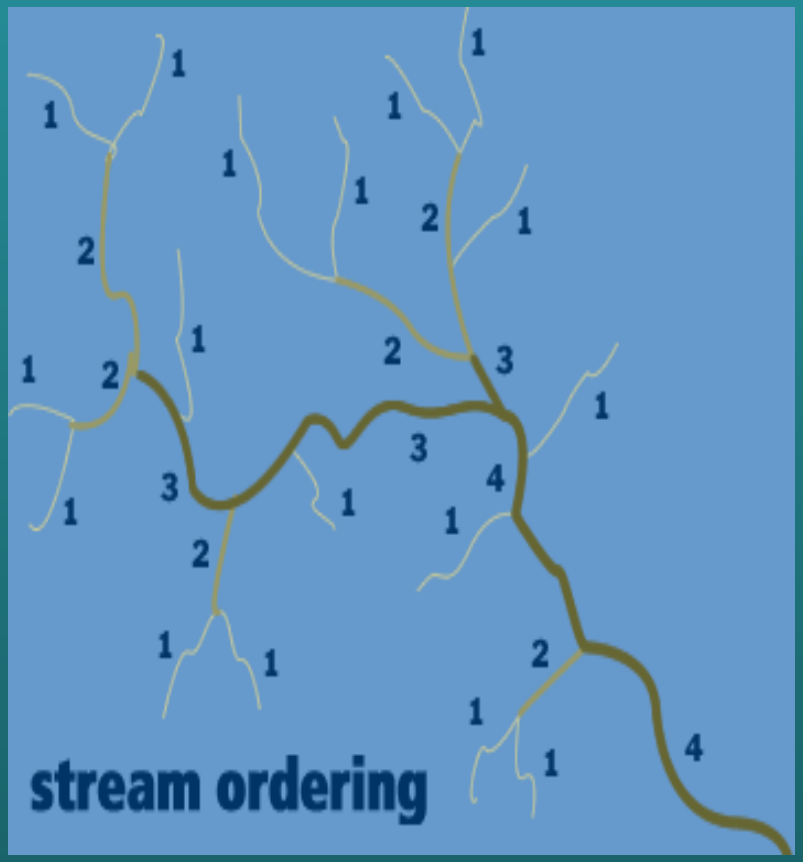
Stream Order:

a measure of the position of a stream in the hierarchy of tributaries



- 1st Order: most upstream, un-branched stream segment
- 2nd Order: begins at confluence of two 1st order streams
- 3rd Order: begins at confluence of two 2nd order streams

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Stream Types: Ephemeral

a feature that carries storm water in direct response to precipitation with water flowing during and shortly after large precipitation events

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Stream Types: Intermittent

A well-defined channel that contains water for only part of the year, typically winter/spring when the aquatic bed is below the water table

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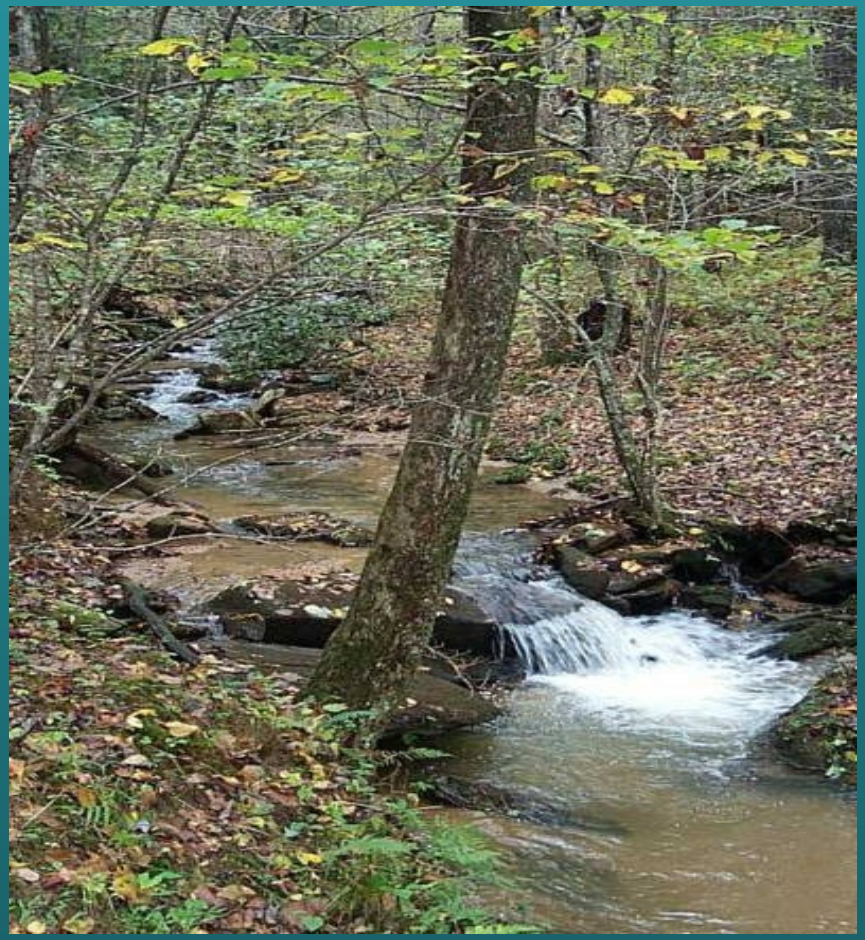
Stream Types: Perennial



a well-defined channel that contains water year round during a year of normal rainfall with aquatic bed below water table for most of the year

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Stream Identification Tools

- USGS Topographic Map
- NRCS Soils Map
- Watershed size
- Geomorphic Indicators
- Hydrologic Indicators
- Biologic Indicators

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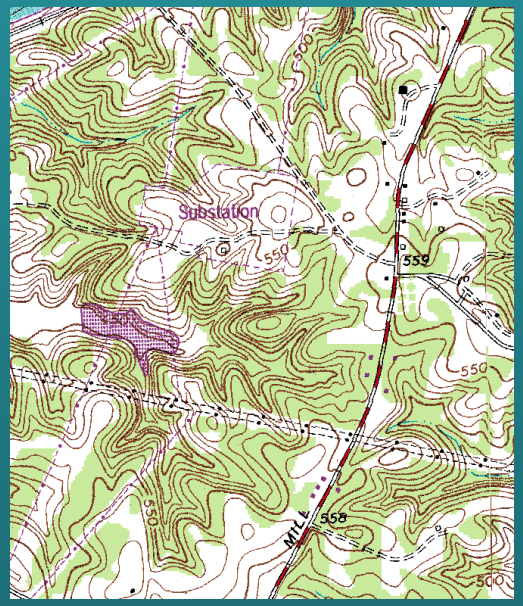
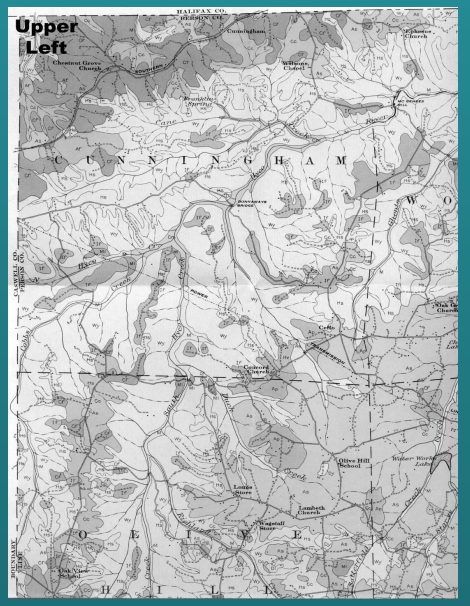
Stream Identification:
Survey Maps

- Most first, second, and third order headwater streams are not represented on topographic maps.
- Paper maps and their digital equivalents often miss up to 80% of the headwater network in some regions. (Colson 2006)





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Stream Identification:
Watershed Size

Studies have shown that catchment size at the intermittent origin ranges from 2.4 acres to 15.6 acres and 10.1 acres to 25.8 acres at the perennial origin. However, drainage area *does not* appear to be a simple predictor of stream origin location.

(Howard 2007)

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Stream Indicators:
Geomorphic

- Continuous bed and bank
- Sinuosity
- In-channel structure/RP
- Soil texture/soil substrate
- Depositional bars
- Braiding
- Recent Alluvial Deposits
- Headcut
- Natural Valley/Drainage

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Geomorphic Indicators:
Continuous Bed and Bank

- The bed is the physical confine of the normal water flow.
- The stream banks are the lateral channel margins during all but flood stage.

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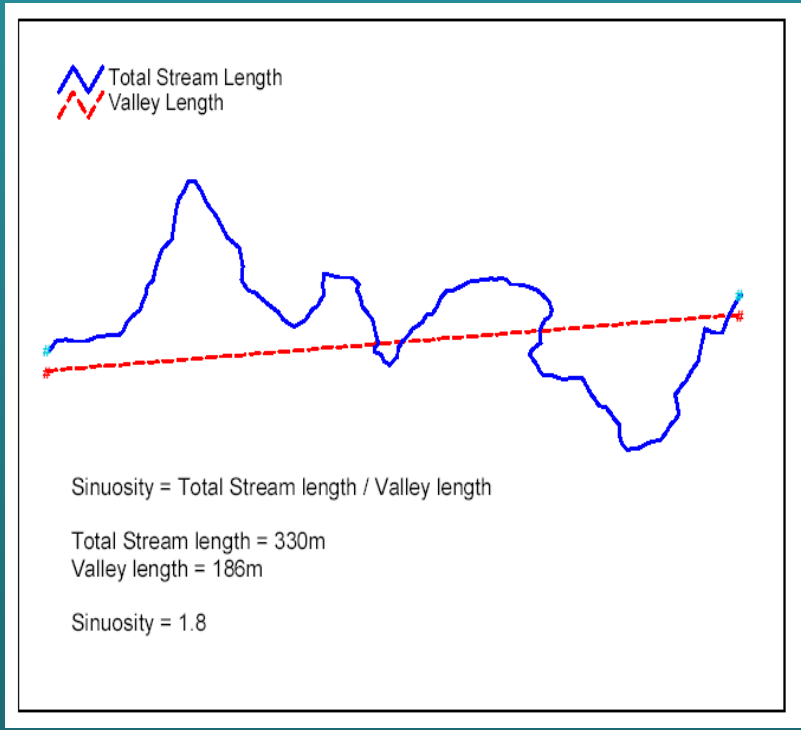
Geomorphic Indicators:
Sinuosity

- Related to slope gradient along the channel
- Intermittent streams generally exhibit a less sinuous channel than the perennial stream


Total Stream Length
Valley Length
Sinuosity = Total Stream length / Valley length
Total Stream length = 330m
Valley length = 186m
Sinuosity = 1.8

(source:http ://h2o.enr.state.nc.us/ncwetlands/documents/NC Stream ID Manual.pdf

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Geomorphic Indicators:
In Channel Structure

- A repeating pattern of riffle/pool can be readily observed in perennial streams.
- Riffle/run in lower-gradient, ripple/pool in sand bed streams, and step/pool in higher gradient steams

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Geomorphic Indicators:
Soil Texture/Substrate Sorting

- Is soil texture in stream bed similar to soil texture outside the channel?
- Is there an even distribution of various sized substrates?
- Does the channel have coarse-textured bottom sediments? (sand/gravel/cobble in piedmont, gravel/cobble/stone/ boulder in mtns, medium/coarse sand in coastal plain)

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Geomorphic Indicators:
Depositional Bars

(source:http://www.co.fairfax.va.us/dpwes/watersheds/ps_protocols.pdf)

- The presence of deposition bars or benches imply that the channel experiences a relatively continuous hydrologic regime.

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Geomorphic Indicators:
Braiding

- Braided channels occur in shallow, low gradient areas where abundant sediment has a tendency to build up across the stream creating a braided pattern of channels and an extensive floodplain.

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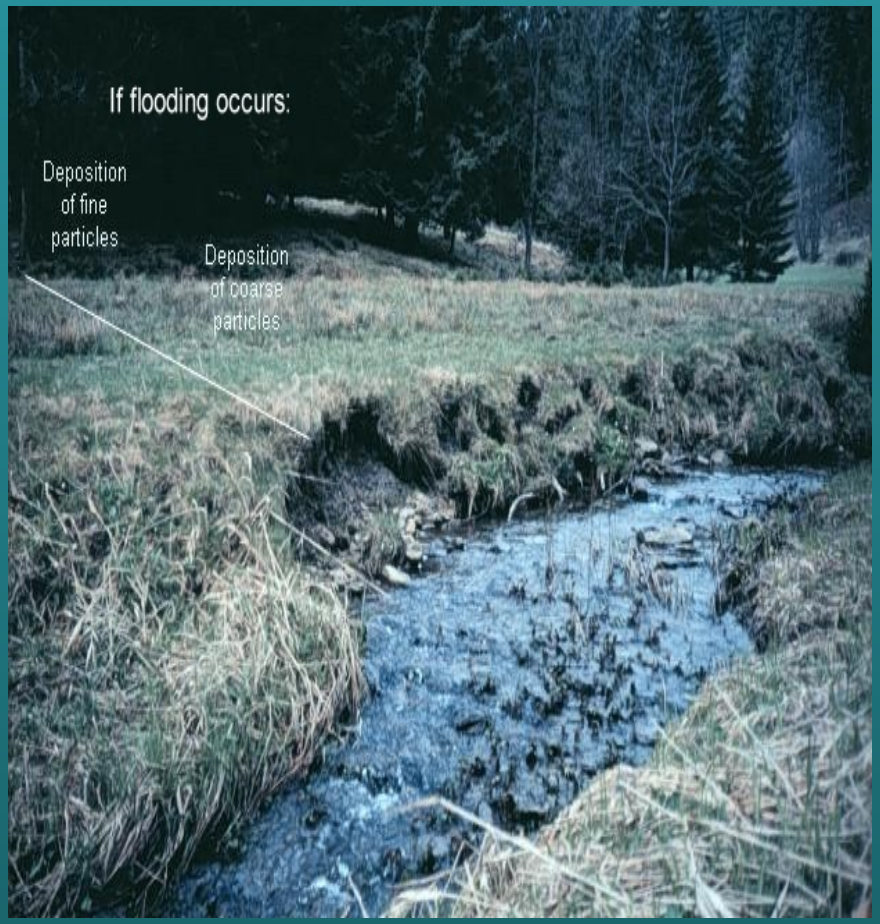
Geomorphic Indicators:
Recent Alluvial Deposits

- The amount of alluvium deposited will indicate whether water is constantly pushing substrate downstream.



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Geomorphic Indicators:
Head Cut

A head cut is an abrupt vertical drop in the bed of a stream channel that is an active erosion feature

(source:http://h2o.enr.state.nc.us/ncwetlands/documents/NC Stream ID Ma

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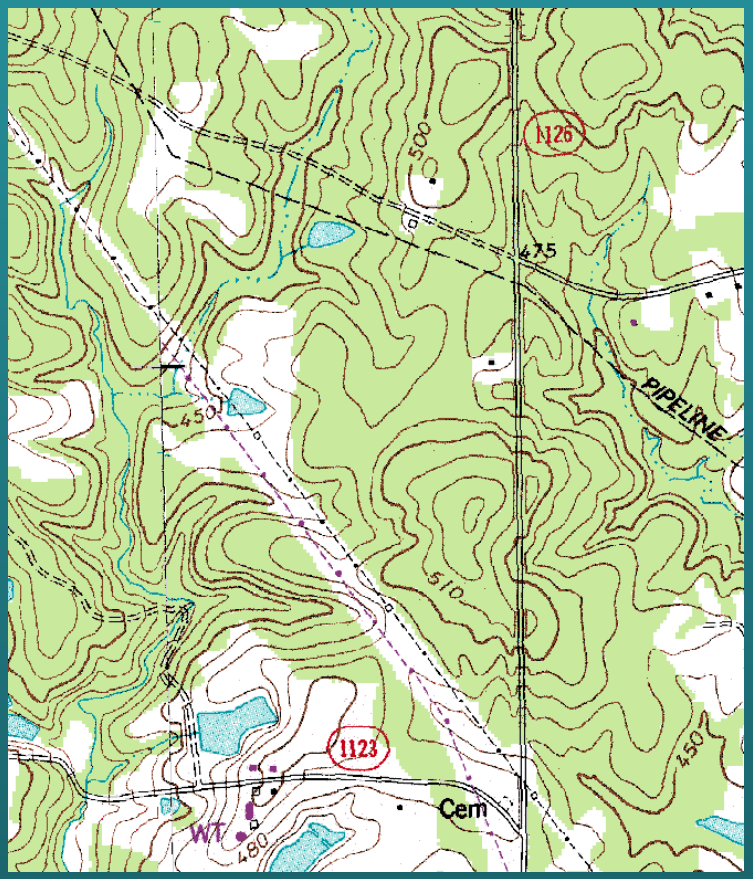
Geomorphic Indicators:
Natural Valley/Drainage

- When looking at topography in the field (or on a topographic map), does the land slope towards the channel or are the contour lines fairly close together and V-shaped or U-shaped, indicating a “draw” or valley?



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Stream Indicators:
Hydrologic

- Groundwater flow/discharge
- Water in channel 48 hours after rainfall event/growing season/dry periods
- Leaf litter
- Sediment on plants and debris
- Organic drift lines
- Hydric Soils

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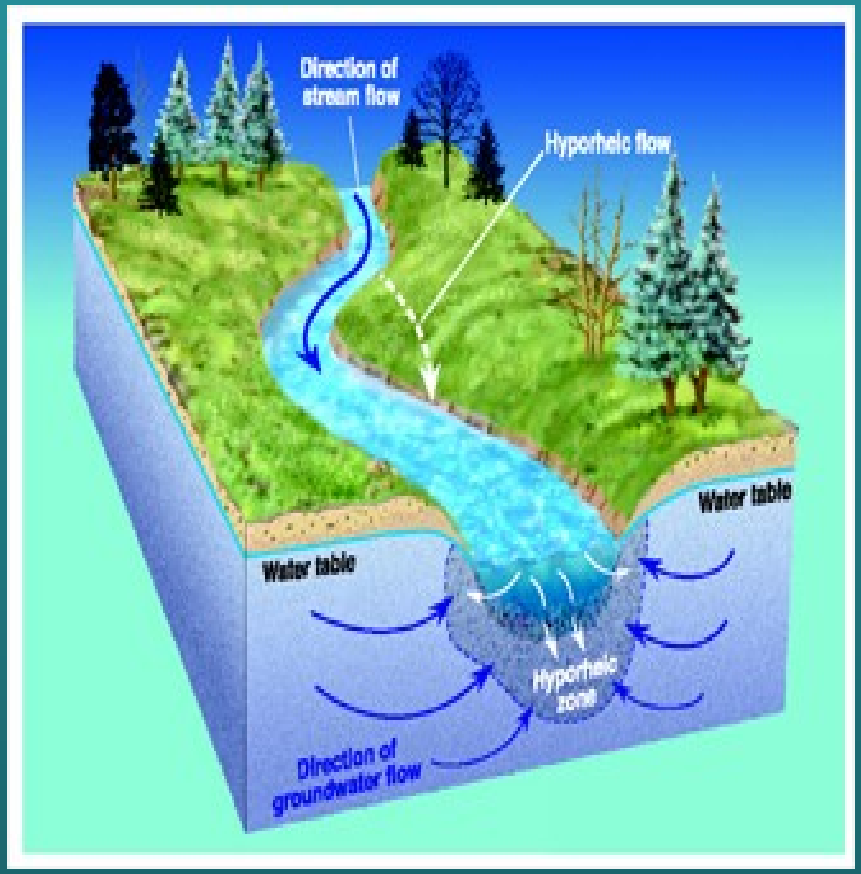
Hydrologic Indicators:
Groundwater Discharge

- Water flowing in the channel more than 48 hours after significant rainfall is clear evidence of groundwater discharge.
- Even if there is no visible flow, there may be slow discharge in the hyporheic zone.



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Hydrologic Indicators:
Water in channel

- Typically, ephemeral channels flow up to 48 hours after a storm event.
- For intermittent streams, look for water in pool areas or in holes in the streambed.
- If a stream exhibits flowing water at the height of the dry season, it conveys water perennially.

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Hydrologic Indicators:
Leaf Litter

- Perennial streams with deciduous riparian vegetation should continuously transport plant material through the channel.

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Hydrologic Indicators:
Sediment on Plants or Debris

- The transport of sediment is a main function of streams.
- Evidence of sediment on plants or other debris in the stream channel may be an important indicator of the persistence of flow.

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Hydrologic Indicators:
Organic Drift Lines

- Organic drift lines (wrack lines) are defined as twigs, sticks, logs, leaves, trash, plastics, etc. piled up on the upstream side of obstructions in the stream, on the stream bank, in the overhanging trees that indicate high flows.

  Streams in watersheds dominated by herbaceous vegetation may not exhibit drift lines

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Hydrologic Indicators:
Hydric Soils

- Are there hydric soils present at the toe of the bank or base of head cuts above the stream bottom, or well-developed hydric indicators in the hyporheic zone?

(source:http://h2o.enr.state.nc.us/ncwetlands/documents/NC Stream ID Manual.p

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Stream Indicators:
Biologic

- Fibrous roots
- Periphyton/green algae
- Iron oxidizing bacteria/fungus
- Wetland plants in streambed
- Aquatic habitat: crayfish/bivalves/ fish/amphibian/macroinvertebrates

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Biologic Indicators:
Fibrous Roots

- Fibrous roots are non-woody, small diameter, shallow wide-spreading roots that often form dense masses in the top few inches of the soil.
- Fibrous roots are intolerant of water.
- In areas of persistent or high energy flows, fibrous roots may be infrequent or absent.

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Biologic Indicators:
Periphyton/Filamentous Algae

These forms of algae are attached to substrate. Visible as pigmented mass/film, or hairlike growths on submerged surfaces.

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Biologic Indicators:
Iron-oxidizing Bacteria/Fungus

- Indicates that the stream is being recharged from a groundwater source.
- Most commonly seen at seeps and springs

(source:http ://h2o.enr.state.nc.us/ncwetlands/documents/NC Stream ID Manual.pdf)

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Biologic Indicators:
Wetland Plants in Streambed

- Small, low gradient, low velocity intermittent and perennial streams with adequate sunlight will often have OBL/FACW plant or SAV in the stream bed.

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Biologic Indicators:
Aquatic Habitat: Crayfish

Most species of crayfish are associated with aquatic or wet environments such as streams and wetlands.

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Biologic Indicators:
Aquatic Habitat: Bivalves

Clams cannot survive outside of water and require a fairly constant aquatic environment to survive

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Biologic Indicators:
Aquatic Habitat: Fish

Fluctuating water levels of intermittent streams provide unstable and stressful habitat conditions for fish communities.

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Biologic Indicators:
Aquatic Habitat: Amphibians

Salamanders and tadpoles can be found under rocks, on stream banks and on the bottom of the channel

(source:http ://h2o.enr.state.nc.us/ncwetlands/documents/NC Stream ID Manual.pdf)

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Biologic Indicators:
Aquatic Habitat: Benthic Macroinvertebrates

The larval stages of many aquatic insects are good indicators that a stream is perennial because of a continuous aquatic habitat is required for these species to mature.

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Macroinvertebrates: Taxa collected from headwater intermittent and perennial streams in North Carolina

- Hemiptera
- Oligochaeta
- Mollusca
- Plecoptera
- Trichoptera
- Coleoptera
- Megaloptera
- Diptera
- Crustacea
- Ephemeroptera

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Special Provisions: Coastal Plain

Reduced topography, which causes fewer channel forming features, can make

the geomorphology section of the stream form problematic in the Middle Atlantic Coastal Plain and Southeastern Plains (Griffith et. al. 2002). In this area, biology should take precedence over geomorphology for determining a stream.

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Intermittent Streams: RPW versus Non-RPW

- A recent stream study in North Carolina indicates that most intermittent streams have continuous flow for 3 consecutive months of the year.

Site Name	Ephemeral	Intermittent	Perennial
Schenck	N	Y(Dec-Apr)	Y
Umstead 1	N	Y(all year)	Y
Umstead 2	N	Y (Jan-May)	Y
Falls 1	N	Y(Jan-Apr)	Y
Falls 2	N	N	Y
Falls 3	N	n/a*	Y
Falls 4	N	Y(Jan-Apr)	Y
Falls 5	N	Y(Dec-Jun)	Y

•Williams, N.B. 2005. Relationship between flow regime and aquatic macroinvertebrate abundance in headwater streams in the Piedmont Region of North Carolina. Masters Thesis, North Carolina State University.

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References

- Colson, T. P. 2006. Stream Network Delineation from High Resolution Digital Elevation Models. Ph.D. Dissertation, Dept. of Forestry and Environmental Resources, NC State University, Raleigh, NC.

- Williams, N.B. 2005. Relationship between flow regime and aquatic macroinvertebrate abundance in headwater streams in the Piedmont Region of North Carolina. Masters Thesis, North Carolina State University.

- Howard, S.M. 2007. Relationship of headwater stream geomorphology to catchment geomorphology in the Piedmont of North Carolina.Masters Thesis, North Carolina State University.

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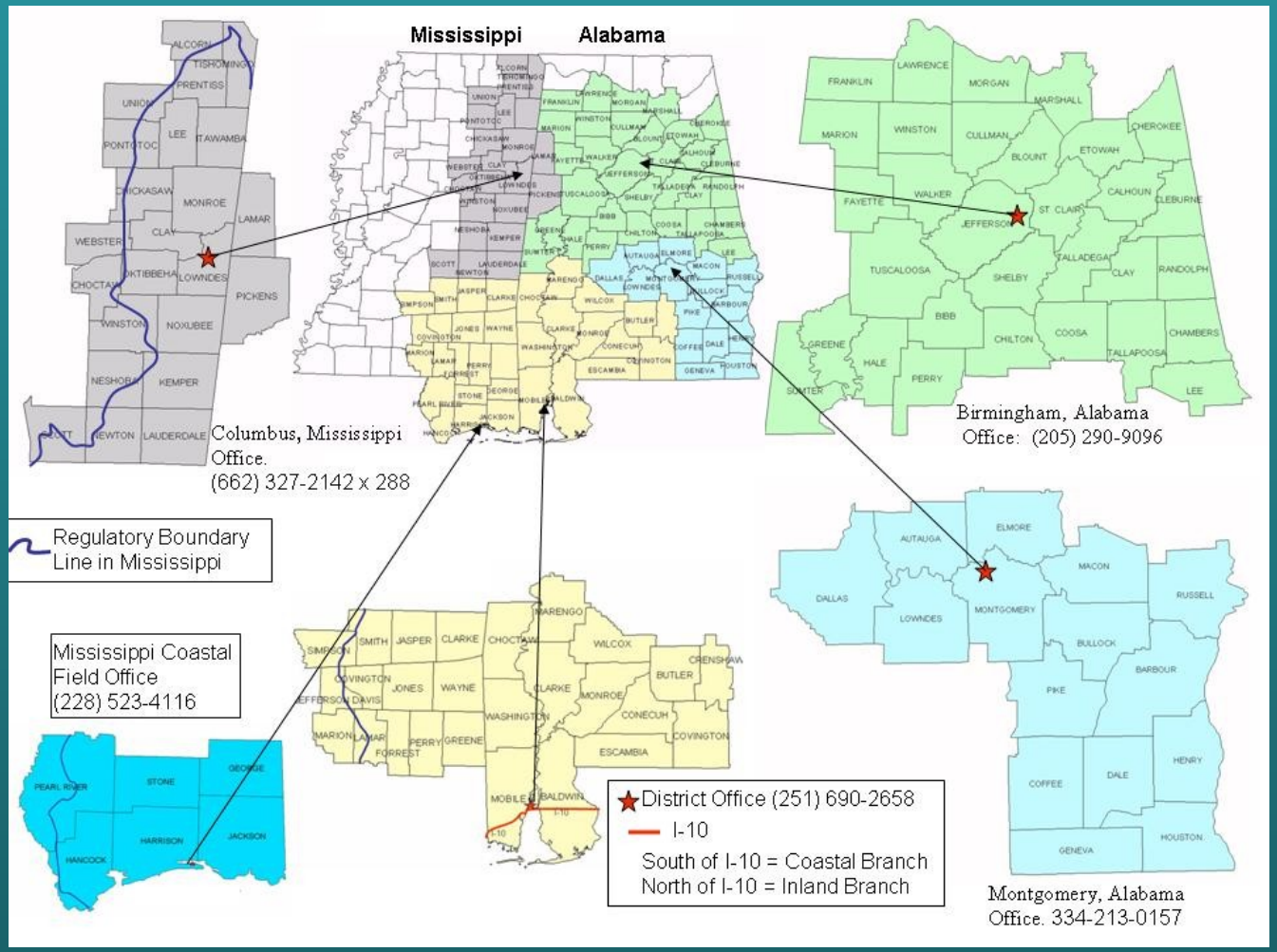
Regulatory Webpage: http://www.sam.usace.army.mil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